EVALUATION REPORT

QUINOA PRODUCTION / PROCESSING PROJECT (ECUADOR)

IDRC PROJECT 90-0160

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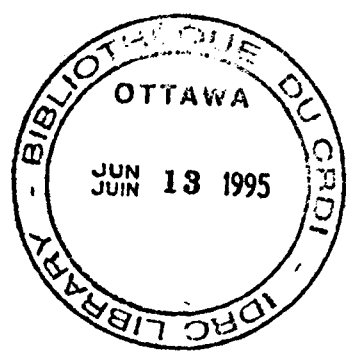

Table of Contents

1. Introduction:

In 1990, the International Development Research Centre (IDRC) in conjunction with the Ecuadorian National Institute for Agricultural and Livestock Research (INIAP) embarked on a 3 year project to study the production, processing and marketing of Andean grains in Ecuadorian Highland communities. This project, entitled Quinoa Production/Processing (90-0160), was a natural progression in IDRC's agricultural research program focused on Andean crops in Ecuador, Bolivia and Peru as it linked production and post-production research concerns in an attempt to better understand Andean food systems in their entirety.

The project coupled basic agronomic and product development research at INIAP's experimental station in Quito with applied study of the production, processing and marketing of Andean grains at a community-operated pilot plant in the canton of Guamote, province of Chimborazo (altitude 3,100m above sea level). Although barley, lupins and faba beans were all investigated, an emphasis was placed on the study of the pseudo-cereal quinoa (*Chenopodium quinoa Willd.*) due to its excellent nutritional properties, its resistance to harsh environmental growing conditions and expanding domestic and international markets for this Andean food.

The specific objectives of the project were as follows: a) To characterize the agroecosystems of Guamote, Chimborazo, with the aim of identifying opportunities to increase incomes through the application of technologies generated by INIAP; b) To continue research and generation of production and post-production technologies in quinoa and other Andean crops; c) To develop and operate a pilot enterprise for production, handling, processing and marketing of quinoa and other grains in the native communities of Guamote, applying post-production technologies developed by INIAP; and, d) To disseminate experiences and results to other communities and other agencies in Ecuador and other Andean countries, through training courses, field days and preparation of audio-visual and textual materials.

In order to maximize the community acceptability of research conducted, the Union of Indigenous Communities of Guamote (UCIG) was a full partner in research and training activities and will continue operation of the plant upon completion of the project. The community-based nature of much of the research and development activities undertaken and the emphasis of the role of women in the project summary merits evaluation of the impacts and benefits experienced by these individuals. In addition, worthy of careful evaluation is the success of the project in linking production, processing, marketing and consumption research activities and the sustainability of the resulting transformations of the Andean grains food system in this region. The following report details findings of a trip to the

project sites in Quito and Guamote from June 23 to July 7 and addresses these issues. Project documents were reviewed and a series of qualitative and quantitative interviews were held with project personnel and community participants to determine the level of community participation achieved in the project, to investigate the evolution of the production to consumption chain during the life of the project and to evaluate the appropriateness of methodologies employed within these key project areas.

2. Methodology:

The terms of reference for the evaluation are presented in Appendix 1 and a diary of trip activities is provided in Appendix 2. Initial interviews were held with the project leaders in Quito and Guamote to orient field work. Information was also cross-checked with these individuals during and following field work. Specific evaluation areas covered and methodology employed were as follows:

i) **the degree of community participation achieved and impact on incomes, labour demand, time allocation and diet, including the impact on the role of women in the community in agricultural production, processing, commercialization and utilization of Andean products;**

Qualitative interviews were held with the project leader and field staff to review their experiences in the conduct of research and development activities with the communities surrounding Guamote. Training activities and the role of farmers (male and female) in steering research activities were assessed. Qualitative interviews were also held with the president of the pilot plant steering committee and the current pilot plant operating staff (4 individuals) to determine their level of satisfaction with project activities including training received, labour demand generated and representation of women among those employed. For specific impacts on labour, time allocation, and diet of women and men in agricultural households, quantitative and qualitative interviews were held with farmers. This phase of the evaluation was less extensive than originally planned as a peasant uprising had taken place in the days immediately preceding the evaluation and community members were understandably suspicious of questions regarding income, agricultural production, labour activities and diet. As community members' lack of comfort with interviewing became apparent, qualitative methods were increasingly used including a shift from individual to group methods. Estimation of income generation was made with project records of prices paid for grains and farmers' reports of estimated yields sold. Dietary and food preference information was elicited through participatory matrix ranking of various products produced by the pilot plant and 24 hour recalls of intake. The original work plan included use of food frequency questionnaires but project field staff indicated that this method may lead to

misrepresentation of intake due to different cultural values ascribed to certain foods. All interview schedules were reviewed with one of the indigenous women working at the plant (Maria Custodia Lema) to ensure that inappropriate questions were not included. Srta. Custodia Lema also attended the interviews to aid in lessening suspicion among community members and to translate questions and responses to Quechua if desired by respondents. Interviews and discussions were held with approximately 22 individuals from farming families both at the pilot plant and during visits to the farming communities of Achullay and San Alfonso de Tiocajas, Sector Palacio Guantana.. Respondents have not been identified to assure anonymity.

ii) the organization of the production to consumption chain resulting from the development of the processing enterprise, with particular attention to marketing, product development, market channels employed, pricing, competition and the sustainability of the enterprise;

Evolution of the production to consumption chain was determined through review of project reports and accounting records with an emphasis on market research completed. Qualitative interviews were held with project staff, the president of the steering committee and indigenous pilot plant staff to determine their level of understanding of the food system chain, marketing decisions, future plans and sustainability of the enterprise. Original plans to interview purchasing agents did not materialize as systematic marketing of the pilot plant's products was not yet taking place. At the Santa Catalina Experimental Station, interviews were held with the individuals responsible for product development research (Nelly Lara and Susana Espin).

iii) the methodologies and activities employed with respect to i) and ii) above.

Methodologies and activities were assessed through review of project documents and reports and through interviews with project staff. The opinions of the project leader were sought regarding the utility of methods and research directions taken during the project. Information regarding methodologies and activities is reported under the relevant sections of the report (Community Participation or Evolution of the Production to Consumption Chain).

3. Results:

A. Community Participation

The Quinoa Production/Processing project , through its community-based nature, included important socioeconomic considerations which were outlined in the project summary. Specifically mentioned were considerations related to poverty, possession of

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3. Results:

A. Community Participation

The Quinoa Production/Processing project , through its community-based nature, included important socioeconomic considerations which were outlined in the project summary. Specifically mentioned were considerations related to poverty, possession of

marginal land, malnutrition, the prominent role of women in the labour force, and the implicit need to set up structures and processes to ensure that community members' voices were heard in the planning of activities (page ii of the project summary, paragraphs 7 and 8). The project's ability to produce impacts in these areas will be addressed in this section of the report.

The project team have largely been successful in motivating community members to participate in research, development and training activities. As might be expected, the participatory element of the project has mainly grown from specific objective (c) of the project, that is the establishment of the pilot plant in the canton of Guamote.

Community participation associated with organization, construction and operation of the plant has been excellent. The enterprise (Agroindustria ICU) is cooperatively owned and operated by 27 indigenous communities and organizations, who have each paid 80,000 sucres (approximately 40.00 USD) to purchase shares. Member communities have possessed a full voice in decision-making since the inception of the plant both through the organization of general assemblies and the election of a steering committee composed of indigenous community leaders (membership changes every 2 years). The project team has expended much effort in explaining the operation of a small business to the share-holders and has been instrumental is devising statutes for the organization of the plant to systematize operations and decision-making. All statutes were put to a vote at a general assembly and are set out along with the plant operating procedures in a comprehensive manual to be used by the enterprise in the future (Manual de Operaciones, Agroindustria ICU). The pilot plant was inaugurated on Nov.27, 1992 and discussion of its viability is presented in Section B -Evolution of the Production to Consumption Chain.

Services provided by the plant and training received both in agricultural production and post-production are currently positively received by community members and individuals employed by the pilot plant. In terms of agricultural production, the credit system offered to promote production of the Andean grains is viewed as one of the most important services offered by the plant. As part of the program, credit is offered in terms of inputs rather than direct cash and includes provision of high quality seed. Manual sowers, pesticide dispensers and a thresher are also lent by the plant as part of the services offered. The thresher is particularly crucial for quinoa which is notoriously demanding to thresh manually. This service generated an income of 2,308,425 sucres (1154.00 USD) for the small enterprise in 1993. Another much appreciated service provided by project personnel are their frequent community visits to offer technical advice in production techniques. This was mentioned as an important benefit of the project by the president of the steering committee and by five farmers during individual interviews.

During the 1993-1994 agricultural cycle, 93 farmers in 27 communities have received credit, services and technical advice. Credit offered this year amounts to 5,405,540 sucres (approximately 2,700.00 USD) and the project leaders report that the plant has been quite successful in receiving payment in previous years. Many farmers only require credit for one year as they produce their own seed for production of these crops in the following year. The production of quinoa (43 families, 36.7 hectares), barley (29 families, 25.7 hectares), faba beans (10 families, 8 hectares) and lupins (11 families, 12.8 hectares) are all being promoted through this program. However, despite the success of the promotion campaign thus far, it was felt by two community members and the project staff that promotion of production needs to be increased, especially that of quinoa. Unfortunately, there were significant losses of quinoa plots in 1992 (approximately 40% lost) resulting from adverse climatic conditions such as prolonged drought and hailstorms and production of quinoa in very high-altitude communities (>3400m). As a result, several farmers are afraid to cultivate quinoa despite the fact that production costs are low and market returns are high (Marchan, 1994). Project leaders have decided to restrict promotion of quinoa production to communities <3400m in the future.

The milling service provided by the plant was consistently mentioned as a beneficial service. Perceived advantages of the mill at the Agroindustria ICU include the fact that it yields a high quality product, the price charged is fair, and indigenous people are treated with respect by the plant employees. For these reasons, the mill at Guamote is preferred over the mills located in the town of Guamote. However, it was also mentioned by several respondents that the capacity of the mill is too small for the demand and users often need to stand in lengthy line-ups. It was stated that more individuals would take advantage of the service if a larger capacity mill was made available. In June, 1994 alone, 71 families from 22 communities used the milling service and in 1993 an income of 3,150,555 sucres (1,575.00 USD) was generated for the business.

Further community impacts resulting from the project include effects on income generation, labour demand and time allocation, diet , and the role of women.

i) Income:

Income generation resulting from project activities occurs through three routes; 1) cash arising from farmers' sales of grains to the enterprise 2) salaries paid to pilot plant employees and 3) profit shares paid to partner communities.

In terms of the first route, producers selling grains to the plant are primarily those that are contracted to do so through the credit program. Average prices paid in early June by the plant were 12,000 sucres (6 USD) for a quintale (100 lbs.) of barley, 30,000 sucres (15 USD) for faba beans and 60,000 sucres (30 USD) for quinoa. When these figures are

multiplied by estimated amounts sold by producers (5.6 quintales of barley, 7.6 quintales of faba beans and 4.5 quintales of quinoa) the income generated for various crops equals approximately 67,200 sucres (33.60 USD) for barley, 228,000 sucres (114.00 USD) for faba beans and 270,000 sucres (135.00 USD) for quinoa. These figures do not represent total income as most producers are multi-cropping (average of 5.5. crops for the farmers interviewed), and many farmers migrate to larger urban centres between the planting and harvesting seasons to generate extra income.

It would be advantageous to increase the number of producers selling their grains to the plant. The plant's policy is to purchase grains from any producer in the region but the majority of producers still choose to sell their grains to the middle-men at the weekly Guamote market. This is unfortunate as the president of the steering committee reported that the indigenous of Guamote have felt exploited by the middle-men for years as they suspect the use of biased scales in the weighing of produce and believe that they receive unfair prices. Agroindustria ICU is viewed by community members as providing an important advantage in the fair weighing of produce. When non-contracted producers were questioned about their reluctance to sell to the enterprise, the consistent response received was that it is difficult to transport grains to the plant. When trucks bring the community dwellers to the traditional market on Thursdays, they are dropped off in the main plaza and it is close to impossible to transport their produce to the pilot plant located on the outskirts of town. Furthermore, the pricing policy of the pilot plant is to offer the same price as the middle-men in the main market. The only exception is that they pay an additional 500 sucres (0.25 USD) per quintale to share-holding community members. Therefore, there is not a price advantage perceived for selling to the plant. This was confirmed during a focus group discussion with community members from San Alfonso de Tiocajas and a representative from one of the women's organizations. It should also be noted that producers still primarily sell on the traditional market day although the plant is willing to purchase grains throughout the week. Sales during the week could potentially be an important benefit if community members required cash for an emergency. Again, the primary constraint appears to be difficulties in transport to the plant. It will be important to improve the transport situation in the second phase of the project so that the benefit of selling to the plant can be extended to more producers (see Recommendations).

The second route of income generation is through employment at the pilot plant. Four indigenous community members have been employed full-time at the plant. Two of these individuals are women and the salary received by each worker is 170,000 sucres (85.00 USD) per month. Their responsibilities and the training received are detailed under the Labour and Time Allocation section of this report.

The third route of income impacts occurs through the partner communities' share of the pilot plant's profits. Allocation of the plant's profits has been formally agreed upon and is included in the plant's organizational statutes. Sixty percent of the profits go directly to the communities for their own discretionary use. The balance of the profits is divided as follows: 10% to the Union of Indigenous Communities of Guamote to develop more projects, 20% to be re-invested in the pilot plant for maintenance and upgrading and 10% to be used for emergencies or disasters that may occur in any of the share-holding communities. As the project is currently trying to maximize its operating capacity and formalize its marketing channels, the share-holders have elected to place the profits in the bank, for the collection of interest and eventual improved operation of the plant. It will be important to provide direction to community members on allocation of cash both for improvement of the enterprise and for community development once the viability of the plant has been assured.

ii) Labour Demand and Time Allocation:

The major source of employment created by the project is the four positions held by indigenous people in the pilot plant. These individuals form the heart of the enterprise and function as grain purchasers, grain processors, and value-added product vendors. All four have received training in various aspects of the enterprise. Three individuals are responsible for managing the inventory (raw material and processed products), operating the machinery, aiding in commercialization, and visiting communities to give technical advice. The fourth individual (a woman) is primarily responsible for managing the cash transactions at the plant and aids with accounting. The president of the steering committee is one of those employed at the plant and assists the project field staff with decision-making regarding the plant. Interviews were conducted with all the pilot plant staff. They displayed ample enthusiasm regarding their employment and reported that they are receiving excellent training. All are young and the women do not yet have children, so they are relatively free to allocate time to the plant. Despite their positive reaction to their employment, these individuals reported feeling ill-prepared to operate the business without project staff. The woman responsible for the cash transactions feels anxious regarding performing accounting functions, one male worker felt uneasy with machinery repairs and more staff overall are required as the staff currently employed are working very hard to cover the plant's various operations. This was confirmed by project field staff. One of the plant workers stated that he would like to see training extended to more community members, so that more individuals would be available to exchange ideas, solve problems and share responsibilities. A desire to extend training was also expressed by community members from Achullay and a representative from one of the women's organizations who

felt that the inner-workings of the plant were a mystery to most of the share-holders. It was recommended by these individuals that community members be allowed to come work for a day or two on a casual basis to learn about the business.

Further impacts on labour demand and time allocation of community members are derived from the lending of the thresher and the mill. The thresher removes one of the main constraints to quinoa production as threshing is traditionally accomplished with manual or animal power. With the mechanical thresher, an entire community's yields can be threshed in 1 or 2 days. Impacts of the mill on time allocation are unclear as most individuals used other mills previously and did not mill at home. Long waits to use the mill should be rectified to avoid wasting valuable time and to increase the number of users. The promotion of "sweet " (low saponin) varieties of quinoa is also an important benefit arising from the project in terms of time allocated to its preparation in the home. These varieties only require approximately 10 minutes to wash compared to approximately one hour for high-saponin varieties.

iii) Dietary Impacts:

In terms of dietary impacts, it is important first to note that small farmers in the Guamote area have not abandoned mixed cultivation and continue to keep a large percentage of agricultural production for their own consumption. Farmers interviewed at the communities of Achullay and San Alfonso de Tiocajas reported cultivating an average of 5.5 different crops and keeping an average of 68.9% for home consumption. The crops commonly sold are barley, potatoes, faba beans and quinoa. Additional crops grown including oca, melloco, mashua, peas and corn appear to be cultivated primarily for home consumption. This maintenance of agricultural diversity is crucial for maintaining dietary diversity as most individuals do not possess adequate income to diversify the diet through food purchases. As an example, twenty-four recall data indicated that the diet currently contains an average of only approximately 14 foods including seasonings. Maintenance of dietary diversity is crucial for maximizing micronutrient intake, an important nutritional issue in this region where 28% of children under 5 years suffer from riboflavin deficiency and 25% suffer from iron deficiency (Freire et al., 1992; Freire et al., 1988).

Farming families cultivating **quinoa** are keeping approximately one-third of their produce for home consumption and report consuming this food approximately 2-3 times per week. Qualitative interviews and participatory matrix ranking indicated that quinoa is an acceptable food to these individuals and is ranked highly on criteria of flavour and importance for good health. Again, home consumption of quinoa is a positive impact and should continue to be encouraged as quinoa is higher in protein, lysine, riboflavin and iron than other grains available in the region. It was also reported by project staff that

consumption of quinoa has been extended to other families through food sharing. Cultivation of quinoa requires additional weeding and hilling compared to the cultivation of barley, and farming families often call on neighbours and extended family to aid in this labour. In return, quinoa is given to these individuals.

Other families in the region are not currently purchasing quinoa nor the other value-added products produced by the plant. Rural consumers do not opt to purchase these foods as they have grains available from their own production and the plant's products are likely beyond affordability. As profits for the plant grow, possibilities should be investigated for special prices or unpackaged products for rural consumers or donations of the plant's products for school snacks or lunches in member communities.

Training has been provided by the project to promote the consumption of Andean foods. Two courses were held with indigenous women with a total of approximately 55 participants. The courses focused on preparation and utilization of Andean grains and responded to a need voiced by community members to introduce novel preparation methods for these foods. Approximately 40 recipes grew out of the courses developed by the women with the help of facilitators. These recipes have been translated into Quechua and the project hopes to publish a bilingual recipe book for use in rural communities. Community response to these courses has been positive and the project leader reported that the women who were trained in the courses have been diffusing the knowledge to non-participants, an effect which should be promoted by the project. It is crucial however, to expand the content of the course to include more information on nutrition. The role of Andean foods in the delivery of macro- and micro-nutrient intake should be demonstrated. The comparative value and optimal mixes of locally available grains and legumes in terms of amino acids and micronutrients must be included, as questions posed to myself by interview respondents revealed a desire for this information. It is also important to reinforce the consumption of wild greens such as "nabo" (wild mustard) which is one of the few sources of Vitamin A and iron available to these families. Potential consumption of quinoa leaves should also be investigated to determine its acceptability. These leaves do not appear to be customarily consumed in this region. This information might be added to the published cookbook and to radio programs to expand diffusion beyond formal courses.

iv) Impacts on the Role of Women in Agricultural Production, Processing and Commercialization:

The project summary for this project emphasizes the prominent role played by women in the production, processing and commercialization of Andean grains. This role is particularly important in Guamote where men frequently migrate to urban centres to

generate cash income. Women have participated in this project but room exists for increasing positive impacts.

One of the most significant strides taken by women is this project is their employment at the pilot plant. Training is being received in the operation of processing machinery and the accounting processes required for the operation of a small enterprise. A second positive impact is the strengthening of a women's organization in the community of Chacaza Alta through their ownership of shares in the plant, and membership of one of their representatives on the steering committee. Training courses targeted at women include the food preparation courses previously described. Women have also participated in agricultural field days along with men, although the project leaders report that they do not feel free to express their opinions in these type of fora.

Despite these advances, the important role of women as agricultural producers has not been entirely addressed. The realities of women's lives and their workloads were not included in the diagnostic study (specific objective (a)) despite suggestions by this consultant to include women as respondents. Important base-line information was not collected which may have been used to monitor and maximize impacts on women's time allocation. As an example, cultivation of quinoa requires additional weeding and hilling compared to barley, labour traditionally falling under women's domain. Although a representative from a women's organization reported that the extra work is worth the pay-off in terms of added productivity and profits (yields increase 50-75% with 1 hilling and 1 weeding), the acceptability of this added labour should be more formally evaluated. For instance, it is possible that arrangements might be made to help women balance their work loads during this period (about 4-5 days for 1 hectare of quinoa) by providing child care if deemed appropriate. Furthermore, training directly targeted at women needs to be broadened beyond their role as nutrition mediators (food preparation courses) to more fully recognize their role as agricultural and livestock producers. This concern was voiced by several women who desire training in production of guinea pigs, chickens and sheep. Again, as the plant begins to increase its profits, perhaps it would be possible to direct some of the cash resources to this training for women. It is also crucial to offer training in Quechua if possible, as women feel far more comfortable speaking and receiving information in their native tongue.

It must be stated that the project team has for the most part dealt with the gender issue with a great deal of sensitivity. The project leaders report that these communities are largely sexist and attempts to target women's participation.must be made with caution. Project staff were responsible for encouraging gender parity in terms of those employed at the pilot plant and have responded to women's requests for courses on food preparation.

The team has also attempted to work closely with the women's organizations, an important means of strengthening women's access to project resources.

v) Conclusions:

The project team has successfully ensured community participation in the project. The enthusiasm and patience displayed by the project leaders in Quito and in Guamote (Carlos Nieto and Carlos Vimos) has played a central role in this respect. The decision for Carlos Vimos to live in Guamote and the fact that he is from this region originally has proven to be crucial in overcoming community members' suspicions regarding development projects. The project leaders have also maintained a high degree of contact with community members through visits, field days, meetings of the general assembly of plant share-holders and an open-door policy at the plant. As a result, they appeared to be largely in touch with community members concerns regarding the small enterprise. The Andean Crops program at INIAP has also displayed good will by including farmers from Guamote on their planning committee for their research program for the next 3 years. Patricio Marchan, the agronomist that has taken Carlos Vimos' position at the plant , also displays keen enthusiasm and ample abilities to maintain positive relations between the communities and the enterprise.

The disadvantage of this close contact is that the communities look to the project staff for the settling of disputes and decision-making. It is apparent that at this point in time, the communities lack the training and organization to successfully manage the plant independently. While the project staff have successfully set up procedures for making large decisions through a vote at the level of the general assembly, smaller everyday decisions are still made principally be the project staff. It will be crucial for the project staff to step back from this role in the second phase (perhaps during the second year) to a strictly monitoring role to ensure sustainability of the enterprise. This will also allow the project staff to target training needs and alleviate fears of the pilot plant staff who feel ill-prepared to take control of the enterprise.

It was stated by the president of the steering committee that the project has had an important impact in producing confidence in the communities that they can manage their own destiny. The fact that the communities are share-holders also has contributed to this sentiment as they have invested their own resources in the project avoiding dependency relationships that have occurred with other development projects.

In the second phase it will be important to further monitor impacts of the promotion of Andean crop production and consumption in the participating communities. Formal evaluation of impacts has largely been agronomic up to this point without concomitant attention paid to nutritional, health, social, economic and political effects. Research funds

and staff should be dedicated to these factors in the next phase, with an emphasis on improving women's participation.

B. Evolution of the Production to Consumption Chain

i) Andean Grain Production, Processing, and Product Development

The diagnostic study planned as part of specific objective (a) was carried out in the first year of project activities. The study is quite complete (130 farmers were interviewed in 30 communities) in its characterization of local agroecosystems and confirmed the need for both production and post-production alternatives in the region.

Applying information gained during the diagnostic, project staff successfully organized a small enterprise in Guamote dedicated to the production, processing and commercialization of Andean grains (specific objective (c)). Promotion of agricultural production has been moderately successful and has been achieved through offering credit and technical advice to small landholders for the production of quinoa, barley, faba beans and lupins. Initial contact with farmers was made by means of community visits, radio programs and word-of-mouth promotion from farmers that have produced with the project in previous years. The project appears to have an excellent reputation in the area and several farmers not currently contracted to the plant expressed an interest in contracts for the following year. Reasons given for this interest include the desire for technical advice and for the high quality seed available through the project. Details of the credit program including numbers of contracted producers are found in the Community Participation section of this report.

Despite the success of promotion, a need clearly exists for increased production in the coming years to improve supply of quinoa to the plant. Quinoa is the product with the highest market demand produced by the plant, yet production is still relatively low in the region (approximately 38 contracted hectares under production in 1993/1994). The community members operating the plant recognize this need and will focus on promotion of quinoa in those communities at an appropriate altitude (<3400 m).

Producers contracted to the plant sell their grains directly to the small enterprise. They are paid at prices consistent with those available at the main market. Income derived from these sales and problems encountered with this system were detailed in the Income section of Community Participation. The community members operating the plant recognize the need to purchase high quality grains and adjust the prices paid to farmers depending on the moisture content of grains and the level of impurities. Numerous different types of grains are purchased including quinoa, barley, lupins, faba beans, rye, lentils, wheat and corn.

Processing performed by the plant includes classifying grains, scarifying quinoa, milling flours and weighing and packaging products. Community members have been employed to perform all the processing and are accomplished at producing high quality products. An emphasis has been placed on quality control by the project team including the production of 100% pure goods, and meeting hygienic and packaging standards. Products currently produced and marketed are barley, wheat, rye, lentils, lupins, corn, faba beans, peas, scarified quinoa, faba bean flour, wheat flour, corn flour, quinoa flour, and machica (toasted barley flour).

Product development research (specific objective (b)) has focused on the de-bittering of lupins for human consumption and new products for amaranth. The lupin work is being conducted by thesis students at the Technical University of Ambato, Faculty of Food Sciences and Engineering and consists of timed boiling and washing to remove bitter alkaloids. Research is also being conducted on agronomic applications for the water used to wash the lupins. The development work completed for amaranth was conducted by nutritionists from the Santa Catalina Experimental Station. The research was market-driven and began with internal and external consumer taste panels to determine the most acceptable products for laboratory development. Research is currently under way to optimize formulae for snack products with an amaranth base.

Product development research and consumer acceptability data for the pilot plant's products was not undertaken. Completion of this research is recommended for the second phase of the project as market niches for the pilot plant's products have yet to be systematically identified. As the nutritionists at Santa Catalina now have a firm understanding of the importance of market-driven research, it is recommended that they undertake this research in the second phase. Of particular importance will be comparisons of consumer acceptability of the pilot plant's products versus those currently available on the market.

ii) Market Channels, Pricing and Competition:

As part of specific objective (a) an extensive market study was conducted by the National Centre for the Promotion of Small Industry (CENAPIA). The study focused on urban marketing of processed products derived from barley, faba beans and quinoa. Consumers (n=881) and retailers were interviewed in 9 Ecuadorian cities including Quito, Ambato, Riobamba, Cuenca and Guayaquil. Levels of consumption and effective demand were established for all products and results were stratified according to socio-economic status of consumers. Unsatisfied demand for barley, faba beans and quinoa were reported to be 15.57 tonnes, 18.65 tonnes and 7.99 tonnes, respectively. Preferred types of packaging and weights of products were established for the pilot-plant's products.

Through qualitative and quantitative interviews with retailers, it was determined that the primary marketing problems associated with these products are poor supply and quality. It appears therefore, that there should be opportunities for the pilot plant's products to enter the market as they guarantee 100% purity and have established quality control measures.

The report is extensive and provides comprehensive information for the cities studied. However, the strictly urban nature of the information collected constitutes a drawback as no opportunities are identified for consumption by rural dwellers including those living in the town of Guamote. The pilot plant's products are highly nutritious and improving access to these foods among the rural population requires investigation. Furthermore, the report fails to effectively analyze the best markets for the pilot plant's products given its capacity and potential market niches are not identified. It is recommended that a marketing consultant be hired in the second phase to aid the project team in employing the results of the study to guide test-marketing.

Marketing of the pilot plant's products is not yet being conducted in a systematic manner. No formal market research has been completed for the plant's products and as a result, commercialization of several products is slow, particularly those derived from barley and lupins. The quinoa products produced by the plant are those in highest demand and constituted 70% of sales in 1993 (37,881,960 sucres or 18,941. 00 USD). Project staff and community members employed at the plant report that marketing occurs primarily through 2 channels. The first is sales at the plant to urban consumers in Guamote (10%) and the second is sales, primarily of quinoa, to food companies. One consumer from Guamote was interviewed and response to the products was enthusiastically positive, especially in terms of satisfaction with the nutritional properties of the products. The food companies purchasing quinoa include Alimentos Vitales, a health food company in Guayaquil and INAGROFA, an exporter. The plant arranges transport to Alimentos Vitales through a middle-man in Riobamba and sells directly to INAGROFA. The enterprise has not yet signed a formal agreement with the latter company as there is some doubt regarding the plant's ability to produce adequate supply. INAGROFA would be willing to purchase all of the plant's quinoa (up to 800,000 kg) at a price of 1,500 sucres (0.75 USD) per kg. However, it is believed by the project field staff that the price paid by INAGROFA was a bit low and that 2,100 sucres (1.05 USD) is more appropriate. Therefore, there appears to be ample market demand for quinoa products, a fact recognized by both project staff and community members. The problem exists in production. Again, research is required to determine optimal markets for the plant's value-added products and their ability to consistently supply those channels.

Pricing of the plant's products is determined systematically with formulae recommended by CENAPIA. Considerations of raw material inventory, labour, processing costs, depreciation of machinery and a 10-20% profit are all included in the price. Community members employed at the plant understand the formulae and are able to calculate prices proficiently. Examples of prices (per kg) are faba beans = 1109.4 sucres (0.55 USD), machica =645.4 sucres (0.32 USD), scarified quinoa =1046.0 sucres (0.52 USD), quinoa flour =1123.9 (0.56 USD). What has yet to be investigated is how these prices compare with those of the competition in urban markets. A small inventory of competition was conducted by this consultant in 1992 and may be used as a base-line to monitor prices and availability of competing products. A recommendation to this effect was made as part of that report but does not appear to have been followed up on.

iii) Viability and Sustainability of the Enterprise:

CENAPIA aided project staff in the development of careful accounting and control of business transactions and inventory . An accountant is employed full-time at the plant and along with one of the community members maintains careful records of all purchases and sales including the provision of services such as the mill and the thresher. There are 15 basic accounts corresponding to the 15 basic activities of the enterprise. Daily and monthly accounting books are maintained with a summary of the financial situation produced every 6 months and communicated to the share-holding communities. Financial statements produced include a summary of transactions and balances taken from the monthly books, a statement of earnings and losses and a general balance statement with detailed appendices. Inventory control is maintained by means of the "KARDEX" system. As mentioned previously, the indigenous plant employee responsible for cash transactions does not yet feel comfortable with detailed accounting procedures and her training should be stepped up.

According to the financial statements, the enterprise is currently viable. Profits were equal to 7,706,498 sucres (3,853.24 USD) in 1992, 14,008,916.sucres (7,004.46 USD) in 1993 and 5,207,568 sucres (2,603.78 USD) for the first 6 months of 1994. It is crucial to note however, that the salaries of the plant employees have not been included in the accounting statement as they are paid with project funds. Also missing are marketing costs including transport as systematic commercialization is not yet taking place. Both of these factors bring the stated viability of the plant into serious question. Given the estimated demand for the products estimated in CENAPIA's market study, viability can be expected to occur in the future if systematic marketing is undertaken.

Flows through the enterprise require optimization for long-term viability and sustainability. Raw material stores at the plant are currently full and the capacity of the machines has been reported to be too small for optimal flows. Stores at the time of the

evaluation were 30,000 kg of barley, 2,000 kg of lupins, 5,000 kg of faba beans, 1,400 kg of lentils, 3,500 kg of corn, 1,300 kg of rye and 1,200 kg of bitter quinoa. Analysis is clearly required on amounts of grains to be purchased at any one time based on the plant's capacity for processing and marketing. Community members recognize these problems but lack the expertise to analyze and monitor flows.

In a move towards sustainability, the long-term viability of the credit system requires analysis. The enterprise has also not yet been legally registered as the community members voted against this move. Registration should take place in the second phase as it is required for bank credit, foreign investment and legal marketing in urban centres. The business has not yet been fined by the government as it is viewed as a development project. For this reason, taxes are not currently paid but should be accounted for in long-term estimates of viability.

iv) Conclusions:

The project staff has successfully organized a production, processing and commercialization system but the chain requires optimization for long-term viability. Of particular note, is a need to systematize marketing of products and processing flows. It is also desirable to accelerate promotion of production of quinoa in the region as supply is still not adequate. The enterprise appears to be currently production-driven rather than market-driven. An emphasis should be placed on improving marketing in the second phase with full participation of indigenous plant employees as research partners so that business marketing principles are learned. Urban market research may be contracted out to a private firm, to the nutritionists at Santa Catalina or to students and professors in business administration at the universities. The project budget included a staff position for a business administrator but unfortunately the project was unable to contract a suitable candidate for a significant period of time. Rectifying this situation in the second phase will be crucial for the long-term viability of the enterprise.

4. Lessons Learned and Recommendations

This ambitious project offers many interesting lessons that may be applied to similar projects in other parts of the developing world. The experience gained in community-based research demonstrated that clear lines of communication must exist between community members and field staff for projects to be accepted. The ability of this project to place a staff member permanently at the plant was essential for gaining the confidence of the local people and alleviating their suspicions regarding development projects. It was also demonstrated that community members must be allowed to make decisions regarding project directions and research themes. The role of the project staff should be to present

clear alternatives when a decision is required but to allow the local people to have control over the activities that will effect their lives. Encouraging community members to invest in the business through the purchase of shares also permitted an increased sense of ownership over the direction of the project. This project has also played an important role in strengthening local grass-roots organizations such as the Union of Indigenous Communities of Guamote and women's organizations. Extensive training has been provided in the areas of agricultural production, post-production processing, small enterprise development and food preparation. The project has demonstrated the advantage of looking at food problems systematically for targeting weak links along the production to consumption chain.

It has also been learned that commercialization is a crucial step in the food system and integrated projects must plan specific market research activities. Consultants in business administration should be hired early to ensure that the business is market-driven to ensure viability. This project has also shown however, that the business should respond effectively to the needs of local communities. Social scientists should be consulted at the diagnostic stage of the project to identify key areas where projects of this nature may impact the lives of rural dwellers. For example, the inclusion of the services provided by the plant such as threshing and milling saves labour and has helped broaden the impact of the project in the region.

This evaluation has demonstrated that the role of women as agricultural producers must be fully recognized. Women are key actors in the food system at all stages from production to processing to utilization. Training activities must reflect this reality. This project has demonstrated that constraints to women's participation such as sexism may be encountered and must be carefully navigated in the search for appropriate means to ensure their representation. Examples of relevant activities from this project consist of the gender parity maintained in access to employment at the pilot plant, training in the operation of food processing equipment and accounting, and the strengthening of women's organizations.

Key recommendations for the second phase of the project are as follows:

1. Promotion of quinoa production should be stepped up as ample demand exists for these products. However, project planners should encourage continued multi-cropping and home consumption of a high percentage of produce to maintain dietary sufficiency and diversity.
2. Community members must begin to manage the pilot plant as soon as possible including everyday decision-making. Additional business administration training may be required.

Project staff should move to a monitoring role upon the establishment of stable market channels so that community members will be prepared to take control of the pilot plant at the end of the second phase.

3. Training regarding the actual operation of the plant should be extended to community members beyond those currently employed at the plant. This may be accomplished through casual labour arrangements.

4. The procedure for purchasing grains from farmers requires review. Most producers find transport of grains to the plant difficult and continue to sell to middle-men in the traditional market for this reason. Possible solutions include the plant renting a stall in the market or travelling to communities to purchase grains.

5. Pilot plant flows require analysis and optimization. This may include upgrading of the capacity of machinery if necessary.

6. Market research must be undertaken to determine niches for the plant, competition and appropriate channels.

7. Once systematic marketing is taking place, salaries of plant employees and marketing costs must be included in accounting systems and estimates of viability. The business should also be legally registered.

8. Possibilities should be investigated for marketing and consumption of the plant's products among rural dwellers in the area. This may include subsidized prices or reduced packaging or donation of products for rural school snack programs if deemed appropriate.

9. Training for women should include agricultural and animal production techniques and should be offered in Quechua if possible. A gender analysis consultant from the region should be hired early in the second phase to suggest relevant training activities.

Appendix 1: Evaluation Terms of Reference

1. In coordination with Dr. Neil Thomas, to evaluate the activities, results and impact of the project Quinoa Production/Processing (Ecuador).

2. To travel to Ecuador to review project documents, reports, data and results and to interview key participants in the project including the project leader, research team members, field staff and members of the communities at Guamote with respect to community participation in the project, its impact on the community and future plans. Specifically;

   i) the degree of community participation achieved and impact on incomes, labour demand, time allocation and diet, including the impact on the role of women in the community in agricultural production, processing, commercialization and utilization of Andean products;

   ii) the organization of the production to consumption chain resulting from the development of the processing enterprise, with particular attention to marketing, product development, market channels employed, pricing, competition and the sustainability of the enterprise;

   iii) the methodologies and activities employed with respect to i) and ii) above.

3. To identify lessons learned from this project experience and provide recommendations for future research activities, methodologies and actions which integrate market, enterprise and community issues for maximizing project impacts.

4. To provide a detailed report on the findings which will be incorporated into the final evaluation report to be prepared in conjunction with Dr. Neil Thomas (under separate contract). The former should be submitted to the Director General of the Division of Environment and Natural Resources by July 31, 1994.

Appendix 2: Diary of Evaluation Trip Activities

Thursday, June 23, 1994 - Travelled from Montreal to Quito
Friday, June 24, 1994 - Visited Santa Catalina Experimental Station for initial interviews with Carlos Nieto and Carlos Vimos, reviewed pilot plant accounting system, reviewed CENAPIA's market study. Travelled to Riobamba with Carlos Vimos.
Saturday, June 25, 1994 - Travelled to Guamote for first visit to the pilot plant. Toured the premises and interviewed three of the community members employed at the plant (Miguel Munoz, Maria Custodia Lema and Lucinda Ausancala).
Sunday, June 26, 1994: Pilot plant closed so the day was used to review the technical report for the second year of the project and to devise interview guides based on information collected during the first day at the pilot plant.
Monday, June 27, 1994: Interviewed Patricio Marchan, new project field leader replacing Carlos Vimos. Reviewed interview guides with P. Marchan to determine their suitability, arranged community interviews, finished review of the second year technical report.
Tuesday, June 28, 1994: Interviewed Anibela Mora, the accountant for the enterprise. Pre-tested research methods with Maria Custodia Lema to determine their appropriateness. Visit and interviews at the community of San Alfonso de Tiocajas, Sector Palacio Guantana.
Wednesday, June 29, 1994: Held a cross-checking interview with P. Marchan regarding information collected during the visit to San Alfonso de Tiocajas. Visit and interviews at the community of Achullay.
Thursday, June 30, 1994: Market day in Guamote. Reviewed project records regarding prices, interviewed community members visiting the plant including one couple from the Association of Galte Ambrosio Laso, and a woman from the community of San Jose de Chacaza. Interviewed Eliseo Guznay, president of the steering committee, pilot plant employee and secretary of Union of Indigenous Communities of Guamote. Interviewed Carmen Yangol, member of the Women's Association of Chacaza Alta.
Friday, July 1, 1994: Reviewed Patricio Marchan's thesis, reviewed information collected during interviews. Return to Quito with Carlos Nieto.
Saturday, July 2, 1994: Visit to countryside with Carlos Nieto, reviewed notes and organized interview guide for final cross-checking interviews with Carlos Nieto and Carlos Vimos.
Sunday, July 3, 1994: Visit to Santa Catalina Experimental Station. Reviewed operations manual for the pilot plant, reviewed the diagnostic study.

Monday, July 4, 1994: Return to Santa Catalina Experimental Station . Reviewed the research plans for INIAP's Andean Crops program for the next three years, reviewed the agreement between INIAP and FUNDAGRO for transferring management of the project, reviewed the bilingual cookbook produced from the food preparation courses, interviewed Nelly Lara and Susana Espin, nutritionists from Santa Catalina responsible for the amaranth product development research.

Tuesday, July 5, 1994: Meetings at FUNDAGRO with Julio Chang, Bolivar Navas and Susan Poats. Meeting with Jenny Ruales at the Escuela Politecnica Nacional.

Wednesday, July 6, 1994: Final visit to Santa Catalina. Final cross-checking interviews with Carlos Nieto and Carlos Vimos.

Thursday, July 7, 1994: Returned to Montreal.

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